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ABSTRACT

A study is described in which the acquisition of "in," "on," and "under" was studied controlling for the non-linguistic strategies suggested by Clark's (1974) ordered rules, as well as controlling for stimuli bias. Clark's rules were: (1) If Y is a container, put X "in" it: and if Y is not a container, but has a horizontal surface, put X "on" it. This leaves "under" as a last resort. Both neutral and natural toys were used for the present experiment. The nonverbal matching tasks were completed first with the neutral toys, followed by the natural toys. A comprehension task was done first with the neutral toys, then with the natural toys. The subjects were 30 children--16 boys and 14 girls--ranging in age from 22 to 36 months. Results indicate among other things that non-linguistic strategies are a factor regardless of stimuli; 82% of errors on the neutral toys were predicted by Clark's rules. This is taken as an indication that cognitive rules dominate. In addition to Clark's ordered rules, it had also been hypothesized that the specific stimuli used to asses these locative words was a factor. The results of this study support this latter hypothesis as well. The control of cognitive strategy is not sufficient in itself to assure a correct response. The stimuli used for a specific assessment are critical. By changing the stimuli one can increase or decrease the probability of a correct response. (AMH)

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IN, ON AND UNDER REVISITED AGAIN

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There has been considerable research focused on the order in which young children acquire locatives. Much of the work has concentrated on the words 'in', 'on' and 'under', and the results have consistently shown that 'in' is first acquired, followed by 'on' and then, somewhat later, 'under'.

The method commonly used to assess these words involves giving the child toy Y (say a crib) and another toy, X (a doll), which could either be put in the crib or under the crib. The experimenter would either direct the child to "put the doll in the crib," or "put the doll under the crib." There would also be pairs of stimuli contrasting 'in' and 'on' and 'on' and 'under'. For example, a child might be asked to either put a car 'on' or 'under' a bridge, or to put a dog 'in' or 'on' a house with a flat roof.

In experiments using this methodology, the data consistently showed that 'in' was correctly responded to more often than 'on' which was correctly responded to more often than 'under'. Clark (1974) investigated the errors children made on these tasks and concluded that all of the errors could be accounted for by two ordered non-linguistic rules:

1. if Y is a container, put X 'in' it;
2. if Y is not a container, but has a horizontal surface, put X 'on' it.

Obviously, this leaves 'under' as a last resort effort.

To test the validity of these non-linguistic rules, Clark devised the following non-verbal matching task. The experimenter and the child were seated next to one another at a small table. Staying with the doll and crib as an example, the experimenter placed one toy crib in front of the child and an identical toy crib in front of herself. She placed a doll 'on' (or 'under') her crib, then gave an identical doll to the child with the instructions, "make yours just like mine." Pairs of stimuli in which X could be placed 'in' or 'on' Y and pairs in which X could be placed 'on' or 'under' Y were also used. While Clark did not specifically use a doll and a crib, she did use a variety of similar tasks and the results strongly supported the predicted rules. That is, normal 2-year-olds had much difficulty putting X 'on' or 'under' a container Y. Staying with our example, young children had much difficulty putting the doll 'under' the crib. They were compelled to put the doll 'in' the crib even to the extent of sometimes taking the experimenter's doll from 'under' the crib and putting it 'in' also!

It has recently been argued (Wilcox and Palermo, 1975) that the stimuli used in the assessment of these words is an important factor. Might it not be the case that by putting the doll in the crib rather than under it the child was imitating observed experiences. The child is very likely to see babies put in cribs but unlikely to

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observe babies put under cribs. Wilcox and Palermo point out that the stimuli used by Clark were biased toward a response of 'in'.

In the present study, the acquisition of 'in', 'on' and 'under' was studied controlling for the non-linguistic strategies suggested by Clark's ordered rules as well as controlling for stimuli bias. There were two tasks, a non-verbal matching task patterned after Clark's followed by a standard measure of comprehension using the same toys as used in the non-verbal matching task.

Stimuli

There were two types of stimuli used. Special toys were made for the study, neutral toys in which there was no bias from past experience (see Figure 1).

"THE CONTAINER"

An Example of a Neutral Toy

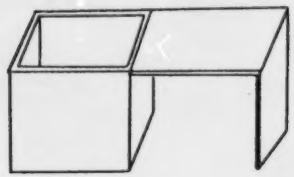

FIGURE 1

They were built on a modular basis. The opening 'in' which something could be put was a 2 inch cube, the surface 'on' which something could be put was a 2 inch square and the area 'under' which something could be put was a 2 inch cube. And a small wooden block was always the object to be put 'in', 'on' or 'under' the neutral toys. There were also natural toys such as toy cups, chairs, sinks, and tables. These natural toys could be combined to reflect past experience with such objects or they could be combined to reflect the opposite of past experience. For example, the child could be asked to put the cup 'on' the table or the chair 'under' the sink, examples of experiences likely to have been observed by the children (positive stimuli bias). On the other hand, the child could be asked to put the cup 'under' the sink or the chair 'on' the table, experiences not likely to have been observed (negative stimuli bias).

Procedure

The procedure was the same for each child, the nonverbal matching tasks were completed first with the neutral toys, followed by the natural toys, the examples of positive and negative stimuli

being randomly sequenced. The comprehension task followed first with the neutral toys, then with the natural toys.

There were three orders of presentation. One third of the children were assigned 'in' as the first nonverbal matching task, one third was assigned 'on' and one third was assigned 'under.' For each child, the order in which the comprehension tasks were done was identical to that of the nonverbal matching tasks.

Subjects

Thirty normal children ranging in age from 22 to 36 months served as subjects. There were 16 boys and 14 girls equally dispersed across the age range.

Results

Table I shows the percent error in response to both the nonverbal matching and comprehension tasks for each type of stimuli.

TABLE I

PERCENT ERRORS IN RESPONSE BY TASK AND STIMULI

	STIMULI		
TASK	Neutral	Positive Bias	Negative Bias
Nonverbal Matching	9.2	8.3	19.2
Comprehension	25.9	17.5	31.7

Examine, first, the pattern of errors on the nonverbal matching task. It appears that non-linguistic strategies are a factor regardless of stimuli. Even with the neutral toys (which should be free of past experiencial bias) children made errors. Of importance is the fact that 82% of the errors made on these toys were predicted by Clark's rules. Note that the percent errors were lowest for the positive biased relations (reflections of observable experience) and greatest for the negatively biased relations (opposite to observable experience).

Comprehension appears to be more than just a reflection of the nonlinguistic rules. Note the errors for comprehension are greater than for the analogous nonverbal matching task. In addition, the stimuli used to assess these words is a critical factor. The percent errors on the positive biased tasks is less than the percent errors on the neutral task, and the percent errors is highest for the negatively biased tasks.

While it appears that non-linguistic rules are a factor regardless of stimuli, it is also clear that the stimuli used to assess the meanings of locatives are themselves a significant factor. Table II illustrates the multiple categorization of each

natural stimuli task.

TABLE II

STIMULI-PAIRS BY ORDERED RULES AND EXPERIENTIAL BIAS

		STIMULI BIAS	
		+	-
ORDERED RULES	+	Cup ON Table Cup IN Sink	Chair ON Table Chair IN Sink
	-	Chair UNDER Table Chair UNDER Sink	Cup UNDER Table Cup UNDER Sink

Each pair of natural toys can be categorized as either reflecting a positive or negative experiential bias. In addition, each pair can be independently categorized as following the ordered rules (indicated in Table I by a plus sign) or contradicting the order of the rules (indicated by a negative sign). For instance, "cup in sink" is not only likely to have been experienced (positive stimuli bias) but also conforms to the ordered rules. Therefore, it would be an example of a "++" category. In contrast, "chair under table" is a positive stimuli bias (likely to have been experienced) but does not conform to the ordered rules; therefore, it would fall in the positive stimuli bias--negative ordered rules category.

Table III gives the errors in response to the nonverbal matching tasks and the comprehension tasks in terms of both stimuli

TABLE III

NUMBER OF ERRORS IN RESPONSE BY STRATEGY

Nonverbal Matching

		STIMULI BIAS		
		+	-	Total
ORDERED RULES	+	1	2	3
	-	9	21	30
	Total	10	23	33

Comprehension

		STIMULI BIAS		
		+	-	Total
ORDERED RULES	+	1	7	8
	-	20	31	51
	Total	21	38	59

bias and ordered rules. It is clear that the ordered rules are dominant over the stimuli effects ($p<.05$ for both the nonverbal matching and comprehension tasks, Binomial test). The most frequent errors were putting the chair 'in' the sink or 'on' the table, both of which are contrary to observed experience but which conform to the ordered rules.

Table IV shows the percent error in response to each word by task and stimuli bias. 'In' is certainly responded to more correctly than either 'on' or 'under' regardless of stimuli. For the neutral toys, 'on' is not responded to more correctly than 'under', either in the nonverbal matching or the comprehension tasks.

TABLE IV

PERCENT ERRORS IN RESPONSE BY TASK, STIMULI AND WORD

	STIMULI								
	Neutral			Positive Bias			Negative Bias		
TASK	IN	ON	UNDER	IN	ON	UNDER	IN	ON	UNDER
Nonverbal Matching	0	13.3	14.4	0	3.3	15.0	6.7	0	35.0
Comprehension	6.7	35.6	35.6	0	3.3	33.3	10.0	13.3	51.7

A word about comparing the data from the natural toys to that of the neutral toys is in order. With the neutral toys, it was possible to contrast 'in' with 'on', 'in' with 'under' and 'on' with 'under'. However, for the natural toys stimuli which permit a contrast between 'in' and 'on' could not be discovered. It was easy to find an X that naturally went 'in' rather than 'on' Y--man 'in' house, car 'in' garage, etc.--but it was concluded after extensive investigation that a stimulus X that naturally goes 'on' a container Y does not exist. It appears that containers are made for the purpose of putting objects 'in' them! Therefore, the comparison across toys (natural vs neutral) is not complete, and the reason the errors on 'on' appear low for the natural toys is due to the lack of natural stimuli to contrast 'in' to 'on'. That is, a test of Clark's first ordered rule with the natural stimuli proved impossible to do.

Table V gives the percent error in response to each word pair. For the neutral toys, 'in' is responded to more correctly than 'on' and more correctly than 'under' in the contrasts 'in-on' and 'in-under', but in the contrast 'on-under', there is no difference in response.

TABLE V

PERCENT ERROR IN RESPONSE BY WORD-PAIRS

STIMULI

TASK	Neutral				Positive Bias				Negative Bias			
	IN - ON		IN - UNDER	ON - UNDER	IN - UNDER		ON - UNDER		IN - UNDER		ON - UNDER	
Nonverbal Matching	0	20.0	0	23.3	3.3	3.3	0	10.0	3.3	20.0	6.7	46.7	0	23.3
Comprehension	6.7	46.7	3.3	46.7	13.3	16.7	0	40.0	3.3	26.7	10.0	63.3	13.3	45.0

Compare the natural toys to the neutral toys for the 'in-under' contrast. The responses to the neutral and the positive biased toys do not differ greatly. However, the responses to the negative biased toys contain many more errors.

Now look at the 'on-under' contrast. In the neutral toys there is difference in errors in response to 'on' or 'under'. However, with the natural toys, there was a strong tendency to put the cup 'on' the table rather than 'under' it, as well as a tendency to put the chair 'on' the table rather than 'under' it.

What is surprising and difficult to explain is the fact that the block went 'on' or 'under' the neutral toy with no real difference in errors. But both the cup and the chair went 'on' the table rather than 'under'. The responses to 'under' were more correct when using the neutral toys than with the positive bias natural toys!

There are definite age trends. Table VI gives the number of errors by age. It is the young children that are erring. And it appears that for them, the ordered rules dominate; the chair is more likely to be placed 'on' the table than 'under' it, and the chair is more likely to be placed 'in' than 'under' the sink. The cup nearly always went 'in' the sink or 'on' the table.

The 30-36 month olds made few errors, but when they did it was primarily to put the cup 'in' the sink.

TABLE VI

NUMBER OF ERRORS IN RESPONSE BY STIMULI, WORD, AGE AND TASK

Nonverbal Matching

AGE in Months	n	STIMULI											
		Neutral				Positive Bias				Negative Bias			
		IN - ON		IN - UNDER	ON - UNDER	IN - UNDER		ON - UNDER		IN - UNDER		ON - UNDER	
22-24	12	0	3	4	1	0	2	0	3	1	9	0	5
26-28	9	0	3	2	0	0	1	0	1	0	3	0	1
30-36	9	0	0	1	0	0	0	1	2	1	2	0	1
Total	30	0	6	7	1	0	3	1	6	2	14	0	7

Comprehension

AGE in Months	n	STIMULI											
		Neutral				Positive Bias				Negative Bias			
		IN - ON		IN - UNDER	ON - UNDER	IN - UNDER		ON - UNDER		IN - UNDER		ON - UNDER	
22-24	12	2	7	0	9	4	5	0	8	1	7	2	10	3	8
26-28	9	0	5	1	4	0	0	0	1	0	1	0	4	0	2
30-36	9	0	2	0	1	0	0	0	3	0	0	1	5	1	2
Total	30	2	14	1	14	4	5	0	12	1	8	3	19	4	12

Discussion

The literature has consistently shown that 'in' is acquired before 'on' which is acquired before 'under'. Two quite different non-linguistic factors have been hypothesized as contributing to this order of acquisition. It has been hypothesized that cognitive rules (independent of specific stimuli pairs) influenced the responses to these words. It was also hypothesized that the specific stimuli used to assess these words was a factor. The results of the present study support both hypotheses: Clark's cognitive rules as well as the specific stimuli used affect the child's response to each of these words. However, the data show that the cognitive rules dominate. The vast majority of the errors made by all the children were predicted by Clark's rules.

There do appear to be non-linguistic cognitive strategies that must be brought under control before the acquisition of locatives can be demonstrated. However, this control of cognitive strategy is not sufficient in itself to assure a correct response. The stimuli used for a specific assessment are indeed critical. By changing the stimuli, one can greatly "increase" or "decrease" the probability of an incorrect response. This has important implications for language assessment. Locatives such as 'in' and 'on' appear relatively early in the language of the young child. Therefore, the assessment of these words is an integral component of nearly all instruments designed to evaluate the young child's language development. The stimuli used in such assessments should be re-examined in light of the present results.

While previous data show a consistent order of acquisition, 'in' being first acquired, followed by 'on' and lastly by 'under', the present results do not unequivocally support such an order. The previous data were collected using natural stimuli, and the data in the present study for the natural stimuli are consistent with the past findings. However, the data with the neutral toys support the early acquisition of 'in', but show no ordering between 'on' and 'under'. In fact, some children exhibited in both the nonverbal matching as well as the comprehension tasks a clear preference for 'under' rather than 'on'. The responses to 'under' for the natural stimuli regardless of bias had a higher percent of errors than the responses to 'under' for the neutral toys. There was a strong interaction effect not between the positive and negative stimuli bias as predicted but rather between the neutral and natural toys regardless of experiential bias. Again, the standard instruments of assessment should be examined in light of this finding.

References

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